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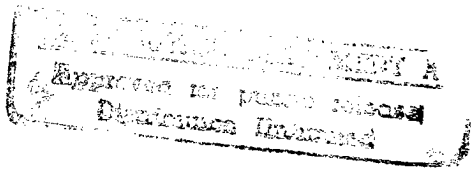

Science & Technology

USSR: Electronics & Electrical Engineering

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Future Television Systems: Interlaced or Progressive Scanning?

907K0249A Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 4, Apr 90 pp 13-16

[Article by M. V. Antipin and L. L. Polisin]

[Abstract] The relative advantages and drawbacks of utilizing interlaced or progressive scanning in future television systems are discussed. The relatively poor efficiency of interlaced scanning from the viewpoint of the utility of the fundamental capabilities of the system resulting from the mismatch between the maximum video signal frequency and the boundary video channel transmission frequency is discussed. It is determined that progressive scanning systems are preferred for future television applications as they have a high efficiency, i.e., extensive potential capabilities for reproducing an equivalent picture quality with a given number of lines. Such a system will provide easier viewing of the system while the picture quality will be higher in a television picture reproduced by a progressive raster compared to an interlaced scanning raster with an equivalent number of active lines. The parameters of progressive scanning systems are compared to the performance of interlaced scanning systems on the basis of a standard number of scanned lines, frame frequency, resolution method, picture format, video picture channel bandwidth, luminance signal, chrominance signal, picture element duration, number of picture elements, etc. The overall study concludes that the optimum design is a progressive scanning system with the same number of standard lines (625) with the frame frequency doubled to 50 Hz. The number of picture elements in this case is only 8% less than an interlaced scanning system with a video channel bandwidth of 20 MHz for the luminance signal.

Effective Video Signal Sampling Structure for Video Spectrum Compression

907K0249B Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 4, Apr 90 pp 21-26

[Article by S. V. Novakovskiy, A. V. Kotelnikov, A. G. Galstyan, L. N. Dzhaparidze]

[Abstract] An effective video signal sampling structure that differs from the MUSE standard is proposed for spectral compression of an initial video signal for the present 625 line standard to 2.25 MHz, i.e., by a factor of approximately 2.7. The implementation of the method will make it possible to double or triple the number of television programs transmitted on existing channels while the experience will find applications for spectral compression up to 6 MHz in enhanced quality television systems which will establish the groundwork for incorporating this system. Detailed timing diagrams and signal sampling techniques are given including graphs of picture line video signal processing and the sampling structure in the first four fields. Interlaced and intralaced interpolator designs are examined. The signal sampling structure proposed here also permits a number of interpolation versions in the receiver for restoring untransmitted samples of picture elements. In this system samples of line elements are clustered in "groups" and a single sample is dropped in the gap between groups. This sampling configuration makes it possible to use different algorithms for recovering samples that are not transmitted and hence there is, in addition to complex forms of interpolation, an algorithm that can be used to achieve a good result without substantial hardware outlay or calculation time. This algorithm is called a "contour interpolation" algorithm and utilizes the derivatives of the sampling envelope of neighboring picture elements. Several other features of this video signal sampling structure are also discussed.

Barrium Ferrite Powder Magnetic Tapes and Disks

907K0249C Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 4, Apr 90 pp. 27-35

[Article by O. A. Berkh, P. P. Olefirenko]

[Abstract] The general properties and characteristics of barrium ferrite powders used for magnetic tapes and disks are reviewed. It is determined that the magnetic properties of the barrium ferrite powders depend on the chemical composition, dimensions, and shape of the powder particles. Several parameters effecting the recording and playback process are discussed including magnetic parameters and the specific surface as well as the diameter, thickness, and diameter-thickness ratio of powder particles; these parameters can vary over a wide range and a detailed listing of these parameters based on reports from different authors are provided. The study also derives the specific magnetization of barrium ferrite at various concentrations of titanium and cobalt as a function of the specific surface. The temperature dependence of the relative coersive force of several barrium ferrite compounds is derived. The amplitude-frequency responses of magnetic tapes are reported together with other working properties of barrium ferrite powder magnetic media. Barrium ferrite disk and film fabrication technologies are also discussed. The optimum properties of these magnetic disks and tapes are attributed to the strong uniaxial magnetic crystallographic anisotropy of the particles as well as the single-domain structure and the extraordinarily narrow magnetization field distribution together with chemical stability.

Error of Colorimetry Instruments and Their Visual Assessment

907K0253A Moscow SVETOTEKHNIKA in Russian No 4, Apr 90 pp 3-6

[Article by V. V. Afonin, V. A. Solovev]

[Abstract] Quantitative relations are established between the individual error components of colorimetry instruments and color differentiation thresholds in units of color coordinates in various regions of color space. Relations are obtained for relating a number of colorimetric parameters. An analytic relation is developed for numerical integration with a uniform sample by the Newton-Kotes method. This analytic relation relates the numerical integration error, the

spectrophotometric sampling step and the spectral characteristic of the test specimen. An analysis of calculations performed using the expressions derived in the study demonstrates that the error of measurement of instruments for most colors exceeds the threshold value at the same time that the reproducibility of the measurement results is comparable to the threshold color differential. The study derives permissible ranges of measurement error of color coordinates in various spatial regions together with the appropriate dependences to establish relationships between the individual components of the total measurement error result, the number of spectrophotometric sampling points and the type of spectral function of the test object.

Design Recommendations for Designing Lighting Engineering Irradiation Systems

907K0253B Moscow SVETOTEKHNIKA in Russian No 4, Apr 90 pp. 12-13

[Article by G. N. Gavrilkina, G. S. Saryche]

[Abstract] Three aspects of designing lighting engineering irradiation systems are considered: the development of technical requirements on the irradiation systems, the irradiation system design and practical recommendations for the units. The specifications on the lighting engineering irradiation systems are reported together with sample data sets for the systems technical designs. A detailed list of ten practical recommendations for lighting engineering irradation system design is given.

Modern Luminescent Lamp Assembly Lines

907K0253C Moscow SVETOTEKHNIKA in Russian No 4, Apr 90 pp. 17-19

[Article by V. A. Pronyakin, V. A. Timonin]

[Abstract] The modernization requirements for luminescent lamp manufacturing and assembly are discussed. It is noted that any further increase in labor productivity or luminescent output cannot be achieved on existing production lines or using present facilities without retooling industry and installing modern high-speed automated rotor-conveyor assembly lines for high-efficiency luminescent lamps. A survey of the current outfitting of a number of facilities is given. Certain gas discharge lamp and electric lamp factories such as the Poltavskiy and Smolensk factories are equipped with the "Tungsram" rotor-conveyor assembly lines. A detailed discussion of the design, output, and technology used in the "Badalex" automated rotor-conveyor luminescent assembly line is given. The Soviet equivalent of the "Badalex" system for reoutfitting luminescent lamp manufacturing at the "Lisma" light engineering production association is also discussed in detail. Diagrams of the various assembly lines are provided.

The International Commission on Illumination. Current State and Prospects

907K0253D Moscow SVETOTEKHNIKA in Russian No 4, Apr 90 pp 19-22

[Article by Kh. V. Bodmann]

[Abstract] The International Commission on Illumination is an independent light engineering organization involved in all scientific, engineering, and cultural aspects of light and lighting applications. The organization was founded in 1913 and became the international authority in light and color measurement as well as illumination and light signal engineering. The goals of this organization are outlined and the current organization of the commission as well as a list of the member nations are provided. A world map showing current member nations of the commission is given along with an organizational map of the national committees, the council and the individual divisions. The specific responsibilities and tasks of the inidividual divisions are also outlined.

The Second International Conference on Light Engineering

907K0253E Moscow SVETOTEKHNIKA in Russian No 4, Apr 90 pp. 29-30

[Article by A. B. Matveyev]

[Abstract] The Second International Conference on Light Engineering held between Jan 22-24, 1990 in Berlin, the German Democratic Republic is reviewed. Several subject areas were covered in the papers presented at this conference including: indoor illumination, outdoor illumination; light sources, radiation sources, and switching equipment; the physiological and psychological aspects of light engineering; photometry; computer technology in light engineering and radiation technology, principles and applications. A total of 84 papers were given at the conference. The precedings at the plenary session and the subject areas of the individual sections are reveiwed. The individual paper titles presented at the subject sections outlined above are provided.

Application of Plastic Tubing for Electrical Wiring

907K0253F Moscow SVETOTEKHNIKA in Russian No 4, Apr 90 pp. 22-26

[Unattributed article]

[Abstract] Instructions on electrical wiring in plastic tubing are given in the form of standards, instructions, and circulars. The areas covered include the field of application of plastic tubing for wires and cables (open and sealed laying and installation); polyethylene tubing; polyvinylchloride nonplastic tubing for electric wiring; hollow tubing from nonplastic polyvinylchloride and consumption standards per 100 m of plastic tubing. Standard design, construction and installation parameters are reviewed such as permissible current levels on cables and electrical wiring, installation and transit points of cables; structures through which tubing is used, etc.

UDC 621.397.25

Development of Methods of Designing Video Signal Interpolators

907K0174A Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 3-8

[Article by S.V. Novakovskiy and A.G. Galstyan]

[Abstract] Reconstruction by interpolation of a discrete video signal from its readings is considered, only a small fraction of all readings being picked up so that the spectrum of a transmitted signal becomes one third or one fourth as wide and an existing communication channel can be better utilized and more easily adapted for transmission of high-definition television images as well. Two basic methods of interpolation are analyzed from the standpoint of this particular application, namely the Lagrange's method essentially used in the MUSE system of coding with multiple subdiscretization and Newton's method. In terms of advantage over a zeroth-order interpolator designed for reconstruction of a reading of an element of the image by simple repetition of the last reading, an interpolator designed for reconstruction of a reading according to Newton's method from four readings taken at four instants of time is shown to be more effective than a linear or first-order interpolator deigned for reconstruction of a reading on the basis of proportional parts and thus from two previous readings. Figures 5; tables 1; references 8.

UDC 621.396:629.7.05

Optimization of Algorithms of Comprehensive Data Processing during Multichannel Radio Direction Finding

907K0174B Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 8-12

[Article by A.S. Bogachev and A.V. Ochnev]

[Abstract] Algorithms of comprehensive space-time primary data processing in a multichannel radio direction finder with a two-dimensional antenna array, in the presence of external interference and internal noise, are constructed according to Markov's theory of optimal continuous filtration with the minimum mean-square error as optimality criterion and according to the principle data distribution. A set of quasi-optimum algorithms is thus constructed for tracking the angular coordinates of an aircraft or spacecraft from a ground source of radio emission. They are based on readings taken within a $[t_0,t]$ time interval and representing a set of three random processes: $\Xi(t)= S(t,\bar{X})+ N_{\Xi}(t)$, $Y(t)= A[H_yX_2(t)]+ N_y]$, $Z(t)= B[H_zX_3(t)+ N_z(t)]$, where $\Xi(t)$ and $S(t,\bar{X})$ are known nonlinear vector-functions of their arguments describing useful signals from the ground source and $N_{\Xi}(t)$ is a set of vectors representing the resultant external interference and the additive internal noise. References 12.

UDC 621.391.82

Immunity of Diversity Reception of Signals with Pseudorandom Tuning of Operating Frequency to Array of Harmonic Interference

907K0174C Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 12-16

[Article by M.R. Kozlov]

[Abstract] Diversity reception of signals in a system of noncoherent binary frequency-shift keying, reception with pseudorandom tuning of the operating frequency, is analyzed for immunity to an array of harmonic interference according to the "probability of error per bit" criterion. Events leading to errors in the presence of not only harmonic interference within a part of the frequency band but also Gaussian white noise are examined, correct reception in the case of a sufficiently high signal-to-noise ratio being ensured when in at least one subsymbol the additional non-signal position is not struck. The probability of error per bit is, accordingly, calculated by multiplying the conditional probability of error per bit by the probability of all subsymbols being struck and by the conditional probability of an additional position being struck when all subsymbols lie within the part of the band which contains the harmonic interference. This probability of error per bit depends on both the band fraction which contains the harmonic interference and the ratio of signal energy per bit to mean spectral power density of harmonic interference. A possibility of maximizing the interference immunity thus being available, namely by optimization of the noise level at a given signal-to-interference ratio, one can determine the minimum ratio of signal energy to mean spectral interference power density and thus the optimum signal-to-noise ratio for a given fidelity of reception. This is demonstrated on reception in a practical situation, namely when the ratio of signal energy to mean spectral interference power density is larger than twice the number of diversity elements and thus also than twice the number of interference tones. Figures 3; tables 1; references 5.

UDC 621.396.96

Identication of Trajectory Parameters from Readings of Mobile Direction Finder

907K0174D Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 16-18

[Article by Yu.G. Bulychev, A.A. Korotun, and A.P. Manin]

[Abstract] An effective method of tracking a moving object with the aid of a mobile direction finder is proposed, all coordinates of the object being determined from all angle readings of such a direction finder. The algorithm of this method is outlined for tracking an object which moves along a rectilinear trajectory, two successive "fixed" positions S_i ,S_j of the object and

corresponding to them two "fixed" positions P_i,P_j of the direction finder being given. The location of the object at the j-th instant of time is then determined by the point where the line P_jS_j crosses the plane $P_iS_iS_j$, that line being drawn on the basis of angles α_j and β_j read by the direction finder. The algorithm is extended to piecewise-linear approximations of trajectories, whereupon statistical processing of direction finder readings is analyzed for random errors due errors of measurement by a mobile rather than stationary direction finder. Estimates are made for x,y coordinates of a moving object, both being linear functions of time but with different intercepts and slopes. Figures 2; references 3.

UDC 621.396.96:512.2

Generating Sequences of Pseudorandom Numbers

907K0174E Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 34-35

[Article by Ye.Yu. Shchetinin]

[Abstract] A generator of pseudorandom numbers is synthesized which satisfies the two requirements for adequate pseudorandomness of numbers in a linear congruent sequence $X_{i+1}= AX_i+ B)\text{mod } M$, namely a sufficiently high power and a maximally long period. The latter is attained by selecting $M= 2^{31}$. High power is ensured by using a random lot of numbers, the random mask of A digits being set up by inverting a unit of the standard built-in DATAN function which yields the value of π twice as accurately, its subsequent multiplication by M/4, and addition of 1 so as to satisfy the general rule of A selection. Selection of B digits is then based on the requirement of minimum sequential correlation. The generator was tested for reliability and efficiency, using all three Smirnov-Kolmogorov, chi-square, and spectral significance criteria. Similarly were also tested four known pseudorandom number generators: two multiplicative ones (1. $A= 2^{16}+ 1$, $B= 0$, $M= 2^{31}$; 2. $A^{16}+ 3$, $B= 0$, $M= 2^{31}$) and two hybrid ones (3. A= 834,314.861, B= 45,386,693, $M= 2^{31}$; 4. A= 421,657,429, B= 45,386,693, $M= 2^{31}$). The results of these comparative statistical tests indicate that new generator is superior to the others in terms of both performance criteria. Tables 1; references 7.

UDC 621.317.757:681.32

Frequency Resolution of Digital Spectrum Analyzers

907K0174F Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 41-44

[Article by S.Ye. Vdovin, V.N. Volynchuk, I.N. Zibrov, V.T. Kovalchuk, and P.M. Povidayko]

[Abstract] Quantitative criteria for the frequency resolution of digital spectrum analyzers operating with discrete Fourier transforms (DFT) are established which, when satisfied, will ensure complete qualitative separation of spectrum components without mutual interference and with the numbers of peaks within the spectrum envelope at the analyzer output equal to the number spectrum components at its input. According to the classical criterion, the frequency separation of components should be wider than the spectral window. According to a more reliable criterion, the frequency separation of spectral components should be wider than the equivalent noise band of that window and thus numerically larger than the factor by which the analyzer reduces the signal-to-noise ratio.Considering that both criteria apply only to spectrum components of equal power and whose frequencies are multiples of the frequency interval on the DFT grid, a more universal criterion is proposed which defines the necessary frequency resolution of a digital spectrum analyzer as $\Delta f_{res}=$ max [begin set] Δf_{PE}; Δf_{PD};$2\Delta f$ [end set] (Δf_{PE}-frequency resolution for spectrum components of equal power, gDf-frequency resolution for spectrum components of unequal power, Δf-width of DFT grid step). These parameters have been evaluated numerically for 3 dB and 6 dB wide spectral windows, Fourier transforms of ten different time windows including square and triangular ones as well as Gauss, Hamming, and Harris windows. Tables 1; references 4.

UDC 621.372.2

Anticipatory Charge-Coupled-Device Filter with Digital Tuning

907K0174G Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 44-46

[Article by S.I. Miroshnichenko and A.V. Bogoslovskiy]

[Abstract] Digital tuning of an anticipatory charge-coupled-device filter is proposed, to facilitate microprocessor-controlled averaging of charges without formation of short pulses and thus eliminate dependence of the charge transfer time on their duration. The principle of such an operation is demonstrated on a three-phase filter. Its transfer ratio, a function of the space frequency ω_x, is calculated by simultaneous solution of two inversion equations and subsequent z-transformation. During the successive first and second inversions of the control voltages a $(1-\varepsilon)/2$ fraction of the initial charge packet is transferred to each of the two potential wells forming on both sides and a η fraction of it remains in place, the $(\varepsilon-\eta)$ rest of it becoming lost in the substrate. In many practical cases both [e]and η are negligible so that the transfer ratio becomes simply $H_n(\omega_x)= \cos^{2n}\omega_x\Delta x/2$ (Δx-space discretization step, n-sequential number of controlled charge averaging cycle). An experiment with a filter in the lower register of a type K1200TsM1 matrix confirmed the design calculations based on $\varepsilon= 0.05$ and $\eta= 0.04$ within 10%. With $\varepsilon= \eta= 0$, the agreement was close only for space frequencies within the intermediate range. Figures 2; references 3.

UDC 621.396.62

Effect of Frequency Synthesizer Nonideality on Characteristics of Digital Receivers

907K0174H Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 47-48

[Annotation of article by A.N. Bondarev, deposited under No 1510-sv at the Center for Scientific and Technical Information 'Informsvyaz']

[Abstract] The performance of receivers with a carrier tracking system and a delay tracking systems in addition to a demodulator of continuous signals phase-shift keyed by a flux of binary information symbols is analyzed for the effect of the nonideality of the controllable digital clock-frequency synthesizer in the delay tracking system, such a device being installed for the purpose of generating reference signals and including a multidigit counter-divider across its output which immensely reduces the nonuniformity of signal phase changes. Simplification of the receiver design by elimination of that counter-divider is considered, which calls for an evaluation of the effect of the resulting synthesizer nonideality on the performance characteristics of all other receiver components. An analysis based on quasi-continuous carrier and delay tracking in the case of independent readings reveals that absence of a counter-divider will not result in a bias error but will appreciably increase the fluctuation error. While its absence in systems with digital convolution of a pseudonoise reference signal does not results in losses besides those occurring in asynchronous systems with ideal digital clock-frequency synthesizers, its absence does result in additional losses in systems with analog convolution of a pseudonoise reference signal. In the latter case, therefore, it is advisable to use a three-level rather than two-level pseudonoise reference signal and a synthesizer based on a cumulative summator with high-speed components. References 6.

UDC 621.391.1

Improving Reliability of Detection Procedure

907K0174I Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 57-59

[Article by V.A. Polyakov and R.G. Tolparev]

[Abstract] The reliability of a detector with a reference noise channel and of its operating procedure based on determination of low probabilities in accordance with properties of extremum rank statistics is shown to be improved when their stability limit for individual anomalous noise spikes has been raised. This applies to the hole gamut of exponential noise distributions, including not only Gaussian, Rayleigh, Rice, Weibull, and log normal distributions but also untypical ones. The said detection procedure involves estimating not the entire noise distribution but only the density along its right-end "tail" in the large-value positive range of the argument, followed by appropriately approximating that "tail" and then determining the necessary resolver threshold for a given false-alarm probability. This procedure, an economical and fast converging one, includes anomalous noise spikes in the data samples and is thus not sufficiently reliable beyond setting the threshold. It is proposed, therefore, that not the largest but also the second largest readings be extracted from data samples. The largest ones will then serve as automatic traps for anomalous readings upon their ranking, while the second largest ones in a samples minus 1 (minus the largest reading) will now represent the extremum statistics for estimation of the "tail" parameters. References 5.

UDC 537.871.6

Phase of Signal Received from Any Moving Point Source

907K0174J Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 59-61

[Article by V.N. Garmash and A.Yu. Seryakov]

[Abstract] Processing a space-time distributed signal from any moving source is considered, a procedure for the necessary estimation of its distortion which depends on the acceleration of that source being proposed and demonstrated on a signal $E(t')= A(t')e^{i\omega' t'}$ (ω' and t' denote the frequency and the time in a system of coordinates tied to the source, $A(t')$ denotes the signal amplitude) coming from a point source of a scalar monochromatic field which moves along an arbitrary trajectory. The signal arriving at a point on the antenna aperture after a time t in a system of coordinates tied to the antenna does not reveal the real position of its source $O',r_o(t')$ relative to that aperture but some previous position $r= r[t-[r<]_o\rangle$of waves propagating through the medium). Following a partial synchronization of both systems at any point of the source trajectory, r_o at time t is determined for any point in the aperture from known parameters characterizing the motion of the source. This is done by a numerical method when an analytical expression for r_o cannot be obtained. Both phase and frequency of the signal arriving at that point at time t are then identified, after both $\Delta t_o'$ as a function of Δt_o and t' as a function of t have been determined. The procedure was tested on a source located at time $t= t'= 0$ at some altitude above the center of a rectangular antenna aperture and moving forth along a rectilinear trajectory inclined at an angle ψ. Its velocity at the time $t= t'= 0$ being V, two situations were considered from there on: in the first one a source moving uniformly at a constant velocity $V(t)= V$ and in the second one a source uniformly decelerated so that $V(t)= V - at$. Both phase and frequency of the incoming signal were calculated, a numerical procedure being necessary in lack of an analytical expression for Δt_o. Figures 3; references 2.

UDC 621.396.677.494

Synthesis of Antenna with Planar Impedance-Type Reflector

907K0174K Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 62-65

[Article by Yu.V. Yukhanov and V.G. Koshkidko]

[Abstract] A planar impedance reflector antenna with an arbitrarily directional radiation pattern is synthesized on the basis of an integral equation which describes the impedance distribution over a given segment of an infinitely long its ideally long plane surface in the approximation of physical optics, an exciter with known radiation pattern assumed to be located at some point selected as the origin of polar coordinates above the surface. The impedance load is designed is to be a periodic array of grooves forming an equidistant of load elements. The design algorithm includes not only integration of that equation but also optimization of the reflector design by minimization of the side lobes in its radiation pattern by the method of sliding tolerance according to the Himmelblau FLEXIPLEX program adaptable for use on a YeS-1061 Standard System computer. Figures 4; references 11.

UDC 621.396.677.001.5

Comparative Performance Evaluation of Cophasal Shortwave Antennas Operating on Multihop Maritime Route ,

907K0174L Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 65-68.

[V. Korolenkov, and Yu.A. Chernov]

[Abstract] An experiment with a cophasal 4/8-tier shortwave transmitter antenna with different vertical radiation patterns as a 4-tier array and as an 8-tier array was made, for a comparative evaluation of its performance when covering over certain periods of time an approximately 10,000 long range above a continuous sea surface under real ionospheric conditions. Unlike reflections of grazing waves by a land surface, their reflections by a sea surface were not expected to boost the field intensity nearly as much as reflections of steeply incident ones. The antenna was tested in the traveling-wave mode of operation, first with only the lower four tiers cophasally connected to the transmitter simulating an autonomous cophasal 4-tier antenna and then with all eight tiers cophasally connected to the transmitter. The same power was thus fed to it from the transmitter in each case. During a 24-h test period it was switched every half hour from one scheme to the other and for the first 2 min following each switch-over excited by pulses of 150 μs duration at a repetition rate of 12.5 Hz. These tests were performed in May-June and then next March-April periods of minimum solar activity. Measurements were made using two receivers, one with a whip antenna and one with a loop antenna, mounted on the first floor (above ground floor) of a building in a coast town with 2-story and 3-story houses. The radiation patterns of their antennas were almost identical within the 0-30° sector. The efficiency of both 4-tier and 8-tier transmitter antennas was determined on the basis of the average receiver voltage readings, averaging over 6 minutes conforming much better to ambient variations and thus yielding more reliable results than averaging over 20 minutes. The efficiency of the 8-tier antenna did not exceed that of the 4-tier one as much as theoretically predicted, evidently owing to nonhomogeneity of both the ionosphere and the sea surface. The results of measurements neither with the whip antenna nor with the loop antenna indicate any consistently higher efficiency of either an 8-tier or a 4-tier transmitter antenna, while theoretical calculations based on reflections by the ionospheric F2 layer only predict an increasingly higher efficiency of an 8-tier antenna as the f/MUF-F2 increases (especially during spring months). The results indicate, however, some advantage of an 8-tier antenna over a 4-tier one during night hours in spring and in summer, probably owing to smaller energy losses in reflection of waves by the sea surface at that time. Figures 2; tables 1; references 4.

UDC 621.396.677.83

Numerical Analysis of Reflector Antennas by Method of Boundary Waves

907K0174M Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 69-71

[Article by V.A. Somov and S.S. Vyazmitinova]

[Abstract] The method of elementary boundary waves is applied to numerical design and performance analysis of reflector antennas in the approximation of physical optics taking into account secondary diffraction, this method having been reformulated by P.Ya. Ufimtsev for refinement of field calculations. It is demonstrated on mirrors with thin smoothly curving edges, each elementary segment of the edge being approximated as the edge of a tangential half-plane. The algorithm of numerical integration by this method yields the nonuniform diffraction component of the current induced by a plane incident wave with a complex amplitude and of the vector field component in either E-plane or H-plane in the far region. The resulting expressions for the elementary boundary waves are valid for all incidence and observation angles, except grazing angles. The calculations are formalized in the International System of units. The authors thank P.Ya Ufimtsev for helpful consultations. Figures 3; references 6.

UDC 621.396.67

Field of Stationary Noise Signal in Radiator Aperture

907K0174N Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 74-76

[Article by O.N. Maslov]

[Abstract] Radiation of a stationary random noise signal with a uniform energy spectrum within a finite frequency

band from a rectangular aperture is analyzed on the basis of Maxwell field equations, which are solved for the angular distribution and the dispersion of noise leaving or entering an aperture antenna. The radiation pattern of a rectangular aperture consisting of elementary electric and magnetic Huygens radiators is calculated by this method, analytically and then numerically, using Cartesian and spherical coordinates with a common origin at the center of the aperture. Figures 3; references 4.

UDC 621.396.96

Changes in Secondary Radiation due to Broadening of Sounding-Signal Spectrum

907K0174O Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 79-81

[Article by V.A. Pastukhov and Ya.D. Shirman]

[Abstract] Changeover from lumped to distributed group source of secondary radiation in a radar system is examined from the standpoint of resulting changes in its effective area upon broadening of the as the signal spectrum, assuming a high signal-to-noise ratio. A group source consisting of two single ones is considered, with given distance L between them and distance R from the radar station as well the respective time delays of their signals. Solution of the problem is based on commutativity of linear scattering and linear signal processing operations in a matched filter this method being simpler than solution based on interference of compound signals in a group radiator. A relation is accordingly obtained describing the dependence of the effective area, a random quantity, on the dimensionless delay time Δft ($\Delta f << f_0$ denoting the spectral width of the narrow-band sounding signal with center frequency f_0), assuming equiprobable magnitudes of the relative phase delay $\Phi = 2\pi f_0(t_2 - t_1)$. An analysis of this relation reveals that the center of secondary radiation will "wander" when $k = L\cos\varphi/\Delta r << 1$ (φ - phase of second signal, $\Delta r = c/2\Delta f$, c - speed of propagating electromagnetic waves) will furthermore split into two when $k < 1$ but not zero. Figures 3; references 4.

UDC 621.396.677.85

Designing Lenses with Homogeneous Dielectric Material

907K0174P Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 87-88

[Article by S.V. Kashin]

[Abstract] Design formulas for planar and axisymmetric radio lenses made of a homogeneous dielectric material are derived from the system of two differential equations of geometrical optics, assuming that the lens either can form a secondary focus or passes radiation from a source with a phase center so that one of the two rays representing an incident wave or a transformed exit wave passes through either a real or imaginary focus. For an analytically focusing lens need to be satisfied not only the focusing condition but also Abbe's sine condition. For a dielectric dome lens must be satisfied the condition for widening of the scan sector, an additional degree of freedom being available for minimization of radiation losses by minimization of the lens thickness for given initial conditions and given ray deflection angle. A unique solution to that system of equations can, under these conditions, be obtained numerically by the Runge-Kutta method on a Standard System computer. Figures 2; references 3.

Soviet-American September 1989 Seminar on Fiber Optics and Optoelectronics

907K0174Q Moscow RADIOTEKHNIKA in Russian No 1, Jan 90 pp 95-96

[Article by G.S. Lantsberg]

[Abstract] A joint Soviet-American on fiber optics and optoelectronics was held, according to schedule, in September 1989 in Moscow. The two delegations represented the All-Union Scientific and Technical Society of Radio and Electrical Communications Engineers imeni Yu.V. Popov and the Institute of Electrical and Electronics Engineers respectively. On the American side participated scientists and specialist from IBM Corporation, Lund University (Sweden), Los Alamos National Laboratory, Columbia University, Central Florida University, Wisconsin University, Bell Laboratories, and Siemens G.m.b.H. (West Germany). On the Soviet side participated scientists and specialists from the USSR Academy of Sciences, namely its Institute of Radio Engineering, Institute of General Physics, and Institute of Engineering Physics imeni A.F. Ioffe, from the Moscow State University imeni M.V. Lomonosov, and from Scientific Research Institutes at relevant Ministries or their Departments. Organizational topics covered at the seminar were Soviet-American cooperation in this field, methods of and outlook for further developments. Topics covering the subject matter were included ion-ion interaction in multifrequency laser media, injection heterojunction lasers for ultrahigh-speed optical long-distance communication lines, effect of heat conduction on breakdown of optically thin films by laser radiation, InGaAsP/InP high-speed photodetectors for fiber-optic communication lines, noise in multilayer avalanche photodiodes, LAD (light-activated diode) lasers, hybrid and monolithic optoelectronic components for fiber optics, optimization of integrated-optics Mach-Zehnder modulator, modulation band of injection lasers with compound selective resonator cavities, coherent reception in nonregenerative underwater fiber-optic systems, theory of self-focusing media and graded-index fiber optics, design of single-mode fiber optics with strong birefringence, compressed light, and multiplexing of fiber-optic transducers by method of coherent frequency refractometry. The members of the American delegation visited

several Institutes of the USSR Academy of Sciences as well as various other educational institutions in Moscow, where they met many high-ranking resident Soviet teaching and research staff, whereupon they also traveled to Leningrad for similar encounters. They also toured Troitse-Sergiyevu in Zagorske, the Hermitage State Museum, and the suburbs Pushkin, Petrodvorets. The next biennial Soviet-American seminar on fiber optics and optoelectronics should be held sometime in 1990-91.

UDC 621.396.967:629.735.33

Mathematical Model and Statistical Characteristics of Speckle Structures in Synthetic-Aperture Radar Images

907K0205A Moscow RADIOTEKHNIKA in Russian No 2, Feb 90 pp 3-8

[Article by L.A. Shkolnyy and S.L. Glazkov]

[Abstract] A mathematical model of speckle structures in synthetic-aperture radar images is constructed in a rigorous manner, for an analysis of their statistical characteristics. It is based on representation of the image formation process by a set of space-time transformation operators on the radar relief function, this function of the space coordinates and time being the complex amplitude of an electromagnetic wave reflected by a surface element into the radar aperture and orthonormalized to the square root of the power density of radiation emitted by the transmitter antenna. Nonlinearity of both the receiver and the signal processing system are disregarded, noise is assumed to be made negligible by adequate suppression, and an estimate of the radar relief function is known to be independent of the phase characteristic of the pulse response. It is furthermore assumed, without loss of generality, that the modulus of the radar relief function is a random process describable as the sum of an average term and a fluctuation term, that the phase of the radar relief function is a stationary Gaussian random process statistically independent of its modulus in the case of a rough and therefore diffusely reflecting surface, and that the correlation integrals of both the phase and the fluctuation term are much smaller than a resolution element of the synthetic aperture. A speckle structure has then a Rayleigh distribution density at the output from the linear second stage of a synthetic-aperture radar and a decaying exponential one at the output from its square-law third stage according to this model. On the basis of this model are, for illustration, analyzed the statistical characteristics of the speckle structure in an image with multiplicative distortions and are indicated ways to compensate these speckle distortions. Figures 4; references 9.

UDC 621.391.161

Accounting from Random Spacing of Radioelectronic Facilities in Estimating Their Electromagnetic Compatibility

907K0205B Moscow RADIOTEKHNIKA in Russian No 2, Feb 90 pp 8-12

[Article by A.I. Yermakov]

[Abstract] Electromagnetic compatibility of radioelectronic facilities is estimated by also accounting for the distribution density of random influencing factors, specifically that of the distance from an interference source to an interference and useful signal receiver. The problem is formulated by defining the location of each facility within its rectangular territory in terms of two coordinates and expressing the distance between the two facility as a random function of two random variables, each variable representing the difference between corresponding two coordinates in a Cartesian system. The general solution to the problem, namely the distance distribution density, is obtained in the form of an integral. It is then reduced to elementary algebraic-transcendental functions for seven combinations of linear distributions (uniform and ramp distributions)) of the four coordinates. Figures 1; references 3.

UDC 621.396.6.001.2:681.3

Algorithm for Estimating Sensitivity of Optimal (Letov-Kalman) Discrete Radioelectronic Tracking Systems

907K0205C Moscow RADIOTEKHNIKA in Russian No 2, Feb 90 pp 18-21

[Article by A.A. Pavlov]

[Abstract] An algorithm is constructed for estimating the sensitivity of discrete radioelectronic tracking systems to transitions and perturbations in the process of their design and optimization. The optimum control signal is calculated by solution of the discrete Bellman equation for the sensitivity as function of discretized time. On the right-hand side of this equation appear two n-dimensional vectors of coordinates, tracked ones and controlled ones respectively, along with a positive-definite penalty matrix representing energy loss on control signals and a nonnegative penalty matrix representing control inaccuracy at any intermediate instant of time. Solution of this equation involves evaluating not only both penalty matrices and another nonnegative penalty matrix which represents control inaccuracy at the final instant of time but also an m-dimensional perturbation vector and three transition matrices of state variables, control variables, and interference variables respectively. The algorithm of the solution yields equations for the sensitivity as a function of generalized variables, the sensitivity of an optimum discrete radioelectronic tracking system being strongly dependent on the absolute values of those variables. References 2.

UDC 621.31.23

Efficiency of Relative Aperiodic Transmission of Compound-Modulated Discrete Messages

907K0205D Moscow RADIOTEKHNIKA in Russian No 2, Feb 90 pp 31-34

[Article by V.N. Bronnikov and Yu.V. Vasilyev]

[Abstract] A modification of relative pulse-time modulation is proposed for transmission of discrete messages over Gaussian channels with random signal reception delay, namely so that the operating time interval becomes a variable dependent on the transmitted information and the protecting time interval can be subdivided either into single operating intervals or into groups of n such intervals. The aim is to raise the transmission efficiency in terms of frequency (γ), energy (β), and information (η) performance indicators. While with n= 1 it is possible to raise the γ-efficiency without lowering the β-efficiency, with n= 2 or > 2 it is possible to raise it by lowering the latter. Considering transmission of a discrete equiprobable message by a signal s(t), the modulation algorithm for n= 1 consists of six steps: message filtration quasi-matched to a single radio pulse signal s(t) - generating a harmonic oscillation synchronized with signal s(t) - synchronous detection in two channels with a reference oscillation in each - finding the extremum of the modulus of each detector output signal within duration of video clock pulses - estimation of the carrier parameters - conversion of these estimates into estimates of binary messages. The algorithm for n = 2 or > 2 uses a different method of determining the position of the received signal in time. All three efficiency indicators are calculated according to the relative principle of coherent reception for bi-orthogonal equipotent and equiprobable signals, with interference from the preceding or following radio pulse disregarded as negligible in terms of relative energy. The calculations are demonstrated on relative aperiodic transmission of messages using 16 such signals and their 16-position amplitude-phase modulation without or with up to 6 bits long convolution codes, or with compound relative time-position modulation. Figures 1; tables 1; references 6.

UDC 621.372.2

Charge-Coupled-Device Space-Frequency Filter

907K0205E Moscow RADIOTEKHNIKA in Russian No 2, Feb 90 pp 46-49

[Article by V.A. Statsenko]

[Abstract] A charge-coupled-device filter for frame transfer of an image in the direction perpendicular to the direction of charge transfer is synthesized, the transfer function of such a filter with a single nondirectional charge transfer by diffusion being approximated as the sum of two linearly independent gaussoidal functions with positive and negative coefficients. An outline of the general procedure, which includes a Gram-Schmidt orthogonalization so as to avoid discontinuities of the second kind, is followed by synthesis of a low-pass filter with a cutoff frequency equal to one half the maximum space frequency passable without distortion of the charge-coupled-device structure. For a numerical design and performance analysis, the results of theoretical calculations are supplemented with experimental data. Figures 1; references 5.

UDS 621.396

Systems of Minimum-Frequency-Shift Keyed Signals

907K0205F Moscow RADIOTEKHNIKA in Russian No 2, Feb 90 pp 60-62

[Article by V.A. Batukhtin]

[Abstract] A method of synthesizing systems of minimum-frequency-shift keyed signals is outlined, such systems featuring negligible extraneous frequency response and excellent correlation characteristics. The object is to minimize peaks of the cross-correlation functions and side lobes of the autocorrelation functions. The method is based on three properties of sums X(k) and Y(k) from n= k to n= N - 1 which determine the values of these functions for signals $s_1(t)= s_1(t,a)$ and $s_2(t)= s_2(t,b)$ representing an a-sequence and a b-sequence of N information symbols $a_n= +/-1$ and $b_n= +/-1$ respectively (k - countable shift, [k]< N). Systems of such signals having a volume V comparable with the base $B= F_cT_c$ (F_c - width of keying frequency band, T_c - duration of single information symbol) or much smaller than or much larger than the base are considered for comparison with systems of nonrestrictively frequency-shift keyed signals, minimum-frequency-shift keying shown to allow a much larger volume of signals without excessive extraneous frequency response and excessive peaks of the autocorrelation functions. Figures 3; references 3.

UDC 621.396.96

Detection of Narrow-Band Signal Amid Spatially Correlated Interference

907K0205G Moscow RADIOTEKHNIKA in Russian No 2, Feb 90 pp 65-68

[Article by V.N. Antipov, O.P. Gulyaykin, and V.A. Yefimov]

[Abstract] An algorithm is constructed for optimal space-time processing of a radar signal, the useful signal being usually picked up by an airborne radar together with interference signals upon their reflection by the ground surface and by a ground radar together with interference signals upon their reflections by moving atmospheric formations. The receiver is assumed to be located in the far field of the transmitter so that it picks up a signal with a plane wavefront in its aperture. It is assumed to pick up not only a narrow-band useful signal and spatially correlated interference signals but also white noise with a known correlation function. The narrow-band signal is

produced by both amplitude and phase modulation of a harmonic electromagnetic field, monochromatic and fixed in space, so that its amplitude and phase have become slowly varying functions of time. Detection of such a signal is achieved with a set of Doppler filters covering the entire spectrum of the useful signal and by noncoherent processing of their outputs. The characteristic of an optimum filter is the weighted sum of the matched in space and time interference characteristic $f_i(x,t)$ and the characteristic targeted for a monochromatic interference of a frequency equal to that of the useful signal, both frequencies being related through the position angle of the interference source relative to the source of useful signals. The transient response of such a filter to an interference pulse is described the Fredholm integral equation of the second kind, its simplest analytical solution being obtained when its kernel is degenerate. Figures 1; references 4.

UDC 621.396.67

Reflection Characteristics of Shields Coated with Atmospheric Precipitation

907K0205H Moscow RADIOTEKHNIKA in Russian No 2, Feb 90 pp 83-86

[Article by D.A. Boyarskiy, N.I. Kliorin, and V.G. Mirovskiy]

[Abstract] The reflection characteristics of shields coated with ice or snow are analyzed, a layer of such a precipitate on an ideal metal substrate being regarded as one of a homogeneous dielectric material characterized by a complex permittivity (snow:ε= 1.4 - j0.001, water: ε= 80.58 - j11.7). This model is valid only for incident waves much longer than the largest dimension of ice or snow particles, only wavelengths $\gamma > 1.5$ cm being therefore considered. The resultant complex reflection coefficient for a vertically polarized electromagnetic wave is calculated on this basis, assuming first a solid metal shield parallel to the ground surface and reflecting at the dielectric-metal boundary all radiation which has passed through the dielectric layer upon its refraction at the air-dielectric boundary. A metal mesh parallel to the ground surface passes some radiation down through the air layer underneath and then a layer of ice or snow to the ground surface, which is also regarded as an ideal reflector. Both modulus and phase of the resultant reflection coefficient depend on the angle of wave incidence and on the relative to the wavelength thickness of the snow or ice layer coating the shield, also on the thickness of the snow or ice layer covering the ground in the case of mesh. Both depend also on the elevation angle of the shield. Their dependence on the angle of wave incidence and on the thickness of ice or snow layers is generally strong for smooth surfaces, surface roughness tending to soften this dependence. Figures 4; references 7.

UDC 621.372.8.029:681.7.068

Characteristics of Fiber-Optic Interferometers for Processing Amplitude-Modulated Incident Light

907K0205I Moscow RADIOTEKHNIKA in Russian No 2, Feb 90 pp 93-97

[Article by B.G. Gorshkov and A.Yu. Kuzin]

[Abstract] Interference of amplitude-modulated light in fiber-optic interferometers is analyzed, coherent superposition being applicable to the interference process in single-mode fibers. The characteristics of three two-arm interferometers for processing amplitude-modulated incident light are calculated on the basis of theoretical relations for the intensity of light leaving each arm. These characteristics are the dependence of both amplitude and phase of the output signal envelope on the net phase shift in the interferometer at the modulation frequency for various values of the reflection coefficient R (K - coupling coefficient, R+ K= 1 in lossless directional coupler), the amplitude of the output envelope being normalized first to the maximum attainable and then to the amplitude of the input signal. These characteristics of a single-mode or multimode fiber-optic interferometers for a noncoherent summation signal are calculated by the method of energy summation, which involves noncoherent superposition. For a single-mode fiber-optic multiple-pass interferometer they are calculated by representing the input signal as the sum of two waves. For a multimode fiber-optic multiple-pass interferometer they are calculated by assuming a sinusoidal input signal so that the signal at the second exit will consist of an infinite number of superposed wave bundles. These characteristics, calculated on the basis of a modulation factor M= 1, are quite different for single-mode and multimode fiber-optic interferometers but indicate that both contrast in the interference pattern and slope of the phase characteristic are in each case essentially retained when interference at the modulation frequency rather than the carrier frequency takes place. Figures 3; references 4.

UDC 621.371

Determination of Transmission Coefficients Characterizing Passage of Decametric Waves through Reinforced-Concrete Wall with Hole

907K0240A Moscow RADIOTEKHNIKA in Russian No 3, Mar 90 pp 5-7

[Article by A.V. Korolenkov]

[Abstract] Analytical expressions are derived for two transmission coefficients which characterize passage of decametric radio waves through a reinforced-concrete wall with a rectangular window, assuming that the total field of such a wave passes through the hole and thus its minimum possible attenuation by outside walls of modern structures. The two coefficients refer to an H-polarized wave horizontally incident at some arbitrary glancing angle relative to the plane of the window. Both coefficients depend on that glancing

angle, on the coordinates of the listener, and on the dimensions (width w and height h) of the window. The expressions for both of them indicate that small windows ($w < 0.1\gamma$, $h < 0.1\gamma$) boost the field intensity at distances about 2 m behind the wall but not the field intensity at 4-5 m behind a wall, where the field intensity is already the same as if the field had passed through a solid wall. Figures 4; references 2.

UDC 550.388.2

Forecasting Maximum Usable Frequencies MUF-F2 for Long Radio Lines Reaching Lower Ionospheric Layers

907K0240B Moscow RADIOTEKHNIKA in Russian No 3, Mar 90 pp 8-9

[Article by R.M. Kubova]

[Abstract] A simple relation is established for estimating the maximum usable frequencies in long radio lines which reach the lower ionospheric layers on the basis of monthly forecasts but also including the effect of reflection by the ionospheric F2 layer which raises the maximum usable frequency above the forecast ones and thus widens the operating frequency band. The proposed magnitude of this effect is ΔMUF = [12- (MUF - F2(4000)- MUS-E(2000)]/3, based on M(4000) approximately equal to 1.1M(3000) and H= 149/ [begin set] [M(3000)+ +gDM]- 176 [end set] km (ΔM= 0 at night). References 6.

UDC 621:519.216

Effect of Fluctuations of Time Discretization Period on Characteristics of Digital Frequency-to-Voltage Conversion

907K0240C Moscow RADIOTEKHNIKA in Russian No 3, Mar 90 pp 44-47

[Article by A.G. Budarin]

[Abstract] A statistical analysis of the digital frequency-to-voltage conversion process is performed for a meandering square-wave input signal and a sequence of control pulses, assuming that the duration of control pulses is equal to one sampling period τ_s and shorter than the time discretization period τ_d. Under consideration is a device consisting of an input pulse counter input followed by a digital-to-analog converter with a smoothing output filter in the measuring channel and a generator of control pulses behind a commutator switch in the control channel. Its performance characteristics, namely mean value and dispersion of its output voltage, are estimated by taking into account fluctuation of the time discretization period and regarding it as a stationary and uniform process. Fluctuations of the sampling period are assumed to be negligible and the filter is assumed to be an averaging one with only one weight function but a very long readout time (much longer than the discretization period, the sampling period, and the input pulse duration). The mean value of the output voltage is found to be linearly dependent on the "frequency" f (inverse of input pulse duration T_0), but not to depend on the discretization noise level σ and on the whole number N part of the improper fraction τ_s/T_0. The dispersion of the output voltage is found to depend intricately on both the input pulse duration and the discretization noise level, nonmonotonically on the latter with a minimum within its low range. Figures 1; references 4.

UDC 621.396.32

Programmable High-Speed Phase and Time Deviation Meters in FM-Signal Forming Systems

907K0240D Moscow RADIOTEKHNIKA in Russian No 3, Mar 90 pp 49-50

[Annotation of article by I.L. Korolev and L.A. Belov deposited under No 1595-sv at the Center of Scientific and Technical Informaion 'Informsvyaz']

[Abstract] A high-speed phase deviation meter with compensation of the sensitivity drift in time is synthesized on the basis of a relation describing the dependence of the phase deviation ν on the time deviation $\xi = \tau_d - \tau$ during frequency or angle modulation, namely $\nu(\tau_d = -\Sigma$ [begin set] $[1+\xi(\tau_d)/\tau]^i]- 1$ [end set] $\tau^i D_i$ from i= 1 to i= N (N- order of the polynomial $\Phi(\tau) = [S\ ]D_i\tau^i$ representing the phase Φ as a function of time τ). For linear frequency modulation with a square-law phase function $\Phi(\tau) = D_1\tau + D_2\tau^2$ this relation becomes $\nu(\tau_d = -\xi(\tau_d D_2$ ($w\tau + D_1/D_2$. High accuracy of this meter is attained by conversion of the nonuniform pulse quantization step into a uniform one during absence of phase errors. For this is proposed a programmable converter of pulse sequences which remains invariant as the law of frequency modulation is changed. In it pulses generated during successive zero-crossovers of the signal are fed to a variable-divisor frequency divider which, in the absence of phase errors, puts out a pulse sequence with a constant period. This provides correction of the variable sensitivity to phase errors. The accuracy of the converter can be further improved by measurement of each time interval between signal zero-crossovers. It then becomes possible to measure time deviations as well as phase deviations from any modulation law. When built with integrated-circuit chips, this converter can operate at speeds up to 50 MHz. Figures 1; references 6.

UDC 621.371

Effective Characteristics of Synthetic Dielectric Materials

907K0240E Moscow RADIOTEKHNIKA No 3, Mar 90 pp 51-52

[Article by L.G. Gazyan and D.N. Vladimirov]

[Abstract] The effective dielectric permittivity of a composite dielectric material, paraffin binder (dielectric permittivity 2.2) with uniformly embedded R10 carbonyl-grade iron filler powder, was measured at microwave frequencies, for an experimental verification of theoretical

estimates pertaining to the dependence of most radiophysical properties of such materials on the powder concentration. Measurements by the open-circuit and short-circuit method were performed on $(0.07\text{-}0.118)\gamma_0$ thick disks (γ_0-wavelength in free space) containing 8-23 vol.% powder concentration, microstructural examination under a "Neophot" microscope with x500 magnification having revealed spheroidal grains with a wide size dispersion. The results agree closely with the Khizhnyak-Khizhnyak formula (VESTNIK KHARKOVSKOGO UNIVERSITETA No 273, 1985) but not with the standard formula (TEORIYA VOLNOVODOV by L. Levin, Izd. Radio i Svyaz, 1981) based on a uniform grain size, which indicates that the grain size dispersion must be estimated and taken into account. Figures 2; references 6.

UDC 621.375.825

Optical Regenerator Based on Hybrid Bistable Device

907K0240F Moscow RADIOTEKHNIKA in Russian No 3, Mar 90 pp 66-68

[Article by V.M. Lukashev, I.A. Goncharenko, and A.F. Rubtsov]

[Abstract] A scheme involving a hybrid bistable optical device on the basis of an electrooptic modulator is proposed for regeneration of optical signals along communication lines. Such a regenerator includes also a photodetector and a feedback amplifier. The combination of feedback control and modulator nonlinearity ensures a hysteretic regenerator output characteristic. The results of a performance and design analysis, which includes a graphical solution of the transcendental inequality defining the condition for system instability, were verified experimentally with an electrooptic modulator consisting of two Li_3TaO_4 crystals and with compensation of natural birefringence owing to the temperature gradient along these crystals. The compensator was a half-wave quartz plate between the two modulator elements with oppositely oriented optical axes. The crystals and the plate were built into a microwave strip, the latter being matched to the exciter and piezoelectric resonance being suppressed by mechanical damping. The static output characteristics of the regenerator were determined with an oscillograph for various magnitudes of the phase shift, the latter being varied by regulation of the constant bias voltage at the electrical input of the modulator. Its dynamic characteristics were measured with an apparatus consisting of an LGN-208 He-Ne laser as light source, two optical attenuators for controlling the optical levels of input signals, a source of bias voltage, an amplifier behind the main bistable modulator, an auxiliary electrooptic modulator for formation of optical signals to be regenerated, a generator of electric pulse signals, a photodetector, and an oscillograph. The incoming laser beam was split for separate excitation of the two modulators, both parts then being recombined behind them for pickup by the photodetector. The results of this experiment confirm the feasibility of such an optical regenerator. Figures 4; references 5.

UDC 621.398:681.7.068.2

Multichannel Fiber-Optic Analog Telemetering Apparatus

907K0240G Moscow RADIOTEKHNIKA in Russian No 3, Mar 90 pp 71-74

[Article by N.M. Kozhevnikov, M.Yu. Lipovaskaya, V.I. Molotkov, Ye.I. Potapov, and A.I. Puchkova]

[Abstract] A compact 3-channel fiber-optic telemetering apparatus with analog data recording has been developed and a laboratory prototype built for experimental evaluation. Each transmitter channel includes a transducer, a voltage generator with frequency modulation, a voltage-to-current converter, and an AlGaAs light-emitting diode. Three optical graded-index fibers with a quartz core 200 μm in diameter and a polymer sheath, welded first two of them and then all three together so as to form two symmetric Y-type directional couplers in series, transmit the optical output signals from the three diodes to a common photodetector consisting of p-i-n Si photodiode preceded by a low-noise field-effect-transistor preamplifier and followed by an integrated-circuit operational amplifier. The amplified electric output signals from this detector are fed into three receiver channels where they pass in each through an intermediate-frequency filter, a limiter, a frequency-modulation demodulator, and a low-pass filter for extraction of the information-carrying signal to be measured with a millivoltmeter. The apparatus was comprehensively tested for metrological performance characteristics and these were found to be satisfactory for various technical applications. The authors thank Yu.R. Nosov for assistance. Figures 3; references 10.

UDC 621.372.8

Power Characteristics of Electrooptic Modulators

907K0240H Moscow RADIOTEKHNIKA in Russian No 3, Mar 90 pp 77-79

[Article by Yu.V. Vaysleyb, V.N. Goncharov, and M.N. Kovachevich]

[Abstract] For a comparative performance evaluation of various electrooptic modulators, analytical expressions for the frequency dependence of the total output power are derived on the basis of their respective equivalent circuits with the phase shift of the optical wave and with the modulation factor taken into account. Numerical calculations covering the 0-3 GHz frequency range have been made and performance curves plotted for traveling-wave, lumped-electrodes, and Barker-code phase-shift modulators. Figures 4; references 6.

UDC 681.846.2:621.397-681.84.083.55

Digital Tracking and Focusing Methods for Laser-Type Playback Systems

907K0240I Moscow RADIOTEKHNIKA in Russian No 3, Mar 90 pp 79-82

[Article by Ye.M. Privalov]

[Abstract] Playback of recorded sound from a carrier by means of a laser system which includes an equilateral right-angle prism is considered, digital following of the sound track and focusing of the reader beam being proposed as an alternative to the analog version. While an analog error signal indicating both the magnitude and the sign of a deviation is formed as the difference between output signals from two photodetectors, formation of a digital error signal involves uniform spatial discretization of the optical signal by a row of photodetectors and averaging the amplitudes of their output signals after they have been measured in a uniform time discretization mode. The process is analyzed in accordance with Kotelnikov's readout theorem stating the condition for equivalence of continuous and discrete movements of the scanning beam, assuming a Gaussian distribution of light intensity and uniform angular width of the sound track for the equation of the field pattern, whereupon the performance of such a system with four photodetectors is analyzed for fidelity of reproduction. A simple processor of both tracking and focusing signals has been designed which automates both functions. It includes two commutator switches feeding one the photodetector output signals and one the readings of these signals to a comparator, a control channel containing a quartz oscillator with a pulse shaper followed by a pulse counter feeding a signal decoder through a control memory, then another counter, two summation and register stages with a divider, and a comparator of tracking or focusing code and processor output code followed by a servomechanism. The hardware is designed to be suitable for any level of standardization and any degree of circuit integration. Figures 4; references 4.

UDC 621.396.677.3:534

Accounting for Diffraction in Radiation Pattern Shaping Interdigital Surface-Acoustic-Wave Delay Lines

907K0240J Moscow RADIOTEKHNIKA in Russian No 3, Mar 90 pp 82-86

[Article by V.G. Kartashev, S.V. Kuzmin, and V.L. Skachkov]

[Abstract] Shaping radiation patterns of multiple-beam antennas with piezoelectric surface-acoustic-wave devices is analyzed by the angular distribution method rather than by the matrix method so that diffraction of waves propagating at the surface of a piezoceramic substrate as well as local reflections can be taken into account. A set of interdigital transducers is considered, a radiator array feeding a receiver array. The condition for absence of diffraction and thus maximum transmission is established for ladder and oblique transducer arrays. While a ladder array can be regarded as a matched and thus optimum space filter, an oblique array is simpler and there are no diffraction lobes in its radiation pattern. Calculations in the approximation of single and thus weak reflection by the receiver array indicate splitting the transducer bars and suppressing local reflections will reduce the level of error signals due to diffraction and thus optimize the radiation pattern. Figures 5; references 3.

Pressure Transducer in High-Temperature Wells

907K0253F Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 90 pp. 20-21

[Article by Yu. D. Kolovertnov, V. I. Sukhanov, V. M. Stuchebnikov, V. I. Fedorov]]

[Abstract] The development of a pressure transducer for use in high-temperature oil and hydrothermal wells is reported. One feature of the transducers used for well pressure monitoring is a long communications line between a primary transducer mounted on the drillhead fitting and a secondary transducer used to provide power and to process the output signal from the primary transducers. The authors of the present study have developed a pressure transducer with a two-wire communications line between the first and second transducer. A diagram of this device is given together with a block diagram of the entire system. Well tests of transducer prototypes were carried out at the Severomutnovskiy Vapor-Hydrothermal Field in Kamchatka. The temperature in this well reached 240 ° C at a pressure of 3.5 MPa. More than 10 round-trips of the long-range well head were tested; these tests revealed the reliability of the transducer as well as the stability and reproducibility of pressure measurement results.

Internal Voltage-to-Periodic Pulse Duration Converter

907K0253B Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 90 pp. 31-32

[Article by Ye. V. Gordeyev, M. P. Tsygankov]]

[Abstract] A voltage-to-periodic pulse duration converter which is used to convert an analog electric signal into a pulse-width series of pulses is described. This device employs two medium-scale integrated circuits. The design employs a method of comparing the measured signal to a reference sawtooth voltage. In this specific design an auxiliary channel is introduced for comparing the reference signal to a zero potential in order to compensate the interfering factors. The article provides a schematic of the converter together with timing diagrams of converter operation. Twelve converter prototypes were developed for experimental testing. The characteristics of these devices are: power consumption: less than 500 mW; primary conversion error at a sweep frequency of 10 Hz: less than .07 in a 0-5 V conversion range. These converters are currently undergoing experimental factory tests.

A Precision Pulse Frequency-to-Integrated D.C. Current and Voltage Signal Converter

907K0253C Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 90 pp. 32-33

[Article by A. M. Izmaylov]]

[Abstract] A precision electrical pulse frequency-to-d.c. voltage and current signal converter design is reported; this design makes it possible to achieve a high degree of conversion precision as well as long-term stability by eliminating the effect of certain current instabilities due to periodic switching. In this design these properties are achieved by switching the similar current values to charge a capacitor and resistor of one filter during one half-cycle and another resistor and capacitor in the opposite half-cycle of the input pulses. Such switching during continuous converter operation virtually eliminates the effect of current instabilities on long-term converter stability. The total conversion error in this arrangement is less than .025 percent. The temporal drift of output signals was less than .02 percent over 24 hours.

The K145 Multichannel Recording System

907K0253D Moscow PRIBORY I SISTEMY UPRAVLENIYA in Russian No 3, Mar 90 pp. 33-34

[Article by V. M. Artamonov, G. G. Stepanenkov, V. I. Grigorev]

[Abstract] The development of the K145 multichannel recording system which employs ultraviolet recording to measure and record 18 variable electrical signals (current levels from 1 microamp to 5 amps and voltage levels from 1 mV to 600 V) as well as nonelectrical quantities converted into electrical quantities between 0 and 10 kHz is reported. The K145 multichannel recording system replaces the K121 commercially manufactured oscilloscope. The K145 has superior engineering and cost characteristics. The system is designed for use in various fields of science and technology for analyzing, testing, and monitoring high-speed processes occurring during pulse pressure, impacts and vibrations, start-up and braking, and for use in dynamic operating conditions of motors, machines, automation and control equipment, devices, and other products. The K145 system consists of an N145 oscilloscope, a set of matching devices, 8 current and voltage limit selectors, and a P029 channel calibrator. The specifications of the K145 recording system are provided together with the primary characteristics of the galvanometers used in the K145 system.

Problems of Cable Television

907K0259A Moscow VESTNIK SVYAZI in Russian No 4, Apr 90 pp. 37-40

[Article by A. I. Kushtuev]

[Abstract] The future development of television broadcasting is linked to a conversion to cable television and the direct distribution of television signals from television programming sources to municipal stations on professional communications channels and by setting up additional services, i.e., developing a unified multifunction cable television system. The many advantages of cable television are discussed including the fact that this form of television broadcasting guarantees high television program reception quality, a substantially broader range of programs on many interests including the pay-per-view options and provides the means for additional services such as audio-only broadcasts, interactive programming, games, data base accessing and other services. The problems involved in developing a future multifunction interactive cable television system are discussed. It is determined that in order to provide a high television program reception quality it is necessary to avoid any over-the-air broadcasting to municipal stations and to convert solely to television signal broadcasting on special communications lines to handle up to 20 programs per service. The over-the-air broadcasting method is recommended for use as a back-up and for delivering signals to the main distribution stations in the cable network on radio relay and satellite communications as well as broadcasting or commercial lines and traditional cable trunks including fiber optic lines. The study determines that the specific television broadcasting systems used to distribute signals to these distribution stations will be selected on the basis of design considerations, i.e., the local terrain, the existence of water and other natural obstacles as well as the need to provide high quality transmission of programming material. A block diagram of a future cable television network is given together with possible hardware configurations and new systems designs.

Automated Monitoring of Radio Broadcast Transmitters

907K0259B Moscow VESTNIK SVYAZI in Russian No 4, Apr 90 pp. 41-42

[Article by A. M. Lokshin, A. Sh. Khazanov, S. V. Pankin, S. Ya. Yauya]

[Abstract] The specialists of the "Radio" scientific production association and the Latvian Regional Radio Engineering Authority have developed and are currently experimentally testing automatic control and monitoring equipment for radio broadcasting and television sound broadcasting transmitters. The equipment provides automatic tolerance monitoring for both monotonic and stereo broadcasting of the quasipeak input program signal level and of the pause duration in the case of zero input signal. The system automatically switches to measure the duration of this pause. In the event of a drop of transmitter power the duration of any substantial reduction or zero power levels are measured. The system monitors tolerances. Three tolerance gradations are used for quasipeak level monitoring and for system gain monitoring: elevated, reduced or extremely low (absent). A block diagram of the system which consists of an analog processor, an analog-to-digital converter, a tolerance processor and pause counter, a display switching unit, a switching unit control circuit, a display panel, a telemetry interface, a detector unit, and signal inputs and outputs is provided. In the event of a loss of input signal to the unit or a loss of output power the display automatically converts to a time count mode with a maximum time count period of 10 minutes. The audio pause duration will be initiated if it extends for more than 10 seconds; both audio and light signals are initiated when the maximum possible pause duration (for example, 1 minute 10 seconds) is achieved.

Laboratory on Wheels

907K0259C Moscow VESTNIK SVYAZI in Russian No 4, Apr 90 pp. 53-54

[Article by S. Zelenskaya]

[Abstract] The "Robotron" enterprise in the German Democratic Republic has developed and begun manufacturing mobile electrical engineering laboratories designed for rapid troubleshooting and fault localization on cable lines of various application. All instruments and equipment used in the laboratory represent a unified test stand ready for operation. Both approximate and precise methods are used for cable troubleshooting. The approximate methods are used to identify short circuit sites or cable fractures or breaks by the reflective pulse method as well as high-resistance or other fault sites by the pulsed high voltage method. The precise test methods include an acoustical method used for fault diagnostics on cables with a high contact resistance and an inductive method used for fault localization and troubleshooting at sites with a low contact resistance; a step voltage method is used for precise determination of ground fault sites.

The Results of the Fourteenth Worldwide Energy Conference

907K0282A Moscow ELEKTRICHESKIYE STANTSII in Russian No 5, May 90 pp. 2-6

[Article by D. B. Volfberg, V. I. Gorin]

[Abstract] The proceedings of the 24th Congress of the World Energy Conference held in September of 1989 in Montreal (Canada) are reported. Over 3200 delegates from 93 nations participated in this Congress. More than 200 scientific and technical papers on various aspects of the state and future developmental prospects of power engineering throughout the world, for individual regions and nations through the year 2010-2020 were presented at the congress. The worldwide figures for power generating capacity and consumption of major nations were reported together with future forecasted levels.

Suppression of Open Arcs in a Single-Phase Fault on a 750 kV Overhead Power Transmission Line

907K0282B Moscow ELEKTRICHESKIYE STANTSII in Russian No 5, May 90 pp 56-61

[Article by V. A. Gamilko, G. A. Yevdokunin, M. B. Kegelas, M. L. Feldman]

[Abstract] Automatic shunting of a failed line phase on both sides after disconnection from the power source is considered for use in quenching open arcs in the event of a single-phase fault on 750 kV overhead power transmission lines. The results are given from calculations to determine the conditions for implementing single-phase automatic reclosing by means of shunting from both sides for 750 kV overhead power transmission lines. A mathematical model of an open a.c. arc was used in the calculations. The tests were run for 750 kV overhead power transmission lines 435 km in length. The result clearly revealed the effectiveness of measures aimed at phase shunting for accelerated suppression of arcing by means of single-phase automatic reclosing. Any final determination of the suitability of using this method on power transmission lines will require experimental research on actual high voltage power transmission lines.

Modifying the Sensitivity Threshold Level of Receivers on RF Communications Channels for Relay Protection

907K0282C Moscow ELEKTRICHESKIYE STANTSII in Russian No 5, May 90 pp. 78-83

[Article by A. I. Leviush, G. V. Mikutskiy, Ye. D. Sapir, Yu. P. Shkarin]

[Abstract] Methods of calculating the sensitivity threshold levels for RF communications channel receivers used in power transmission line relay protection and the recommended values of these levels on various classes of power transmission lines for protection purposes are given together with new concepts relating to the use of special phasing systems in differential-phase RF protection. The analysis focuses on such factors as the calculated average statistical noise level at the central phase of an infinitely long power transmission line with horizontal wiring; the interference level distribution; the time dependence of the average squared corona interference voltage during commercial operation and determination of the threshold level of the receivers. Vector and timing diagrams are given to explain the function of the special phasing used in this design. The study determines that it is desirable to improve receiver sensitivity in order to elevate the operating frequency of the communications channel. The study also recommends using special phasing of the differential-phase protection system. It is also necessary to reduce the minimum receiver sensitivity threshold to -20 dB when developing new RF transceivers.

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